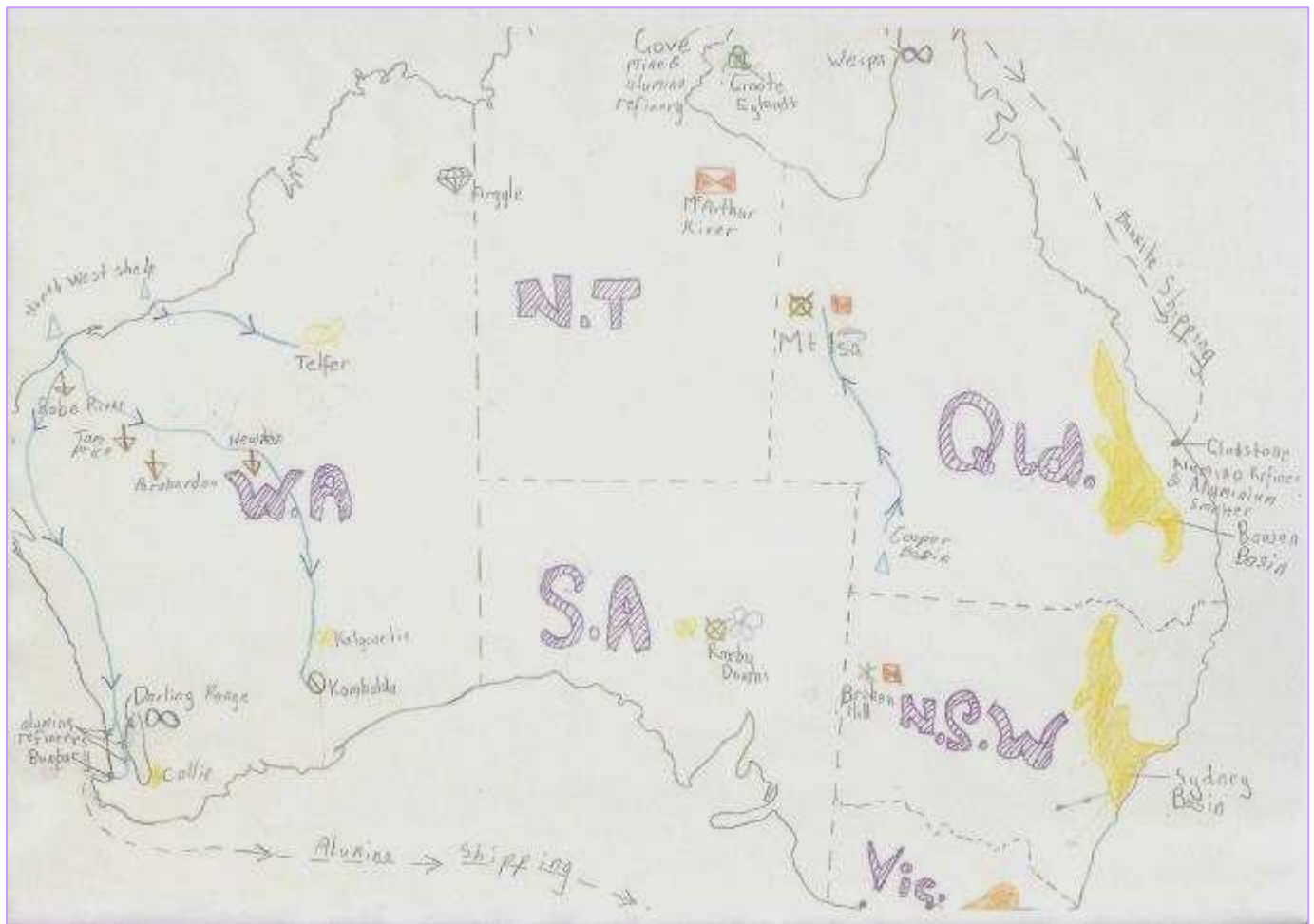


# Kelly's Minerals Project from the Integrated Set "Earth.com" Well done Kelly!

LEGEND			
Mineral	Symbol	Mineral	Symbol
Copper		Bauxite	
Lead-zinc		Iron Ore	
Gold		Silver	
Black Coal Basins		Diamonds	
Brown Coal Basins		Nickel	
Manganese		Uranium	
Natural Gas		Natural Gas Pipeline	



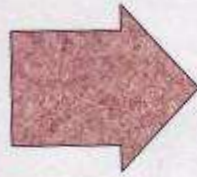
# Bauxite, Alumina & Aluminium

## *Introduction*

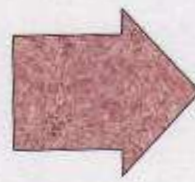
Bauxite is a type of ore consisting of aluminium oxide, iron oxide, clay and sand. This is the natural resource needed to make alumina. Alumina is the raw material then used in the production to make Aluminium



Bauxite  
Natural resource



Alumina Powder  
Raw Material



Aluminium Metal  
Finished product

## *Bauxite Exploration*

Exploration for a Bauxite deposit below the ground starts with Geologists studying maps and samples taken from the surface.

Once an area is thought to contain Bauxite below the ground, then drilling is done. The core samples from the drills are studied by Geologists once again, to find out how much Bauxite is below the ground.

If there is enough Bauxite in the core samples, then large mining companies start to mine the deposit.



*Bauxite  
exploration*

## *Bauxite Mining*

Mining  
Bauxite



Bauxite is drilled and blasted for extraction from open cut mines. Once the rock has been broken, it is then loaded onto haul trucks ready to be transported to primary crushers. This freshly mined Bauxite is crushed in two stages. It is first split into smaller rocks that are less than 18 cm in diameter, then again to less than 3 cm. After it has been crushed, the ore is stockpiled before being transported to Alumina refineries.

Every year more than 100 million tones of bauxite are mined around the world, with more than 40 million tones extracted in Australia. There are 6 bauxite mines in Australia 4 of which are in Western Australia in the Darling Ranges, another in the Northern Territory at Gove and one in Queensland at Weipa.

## *Alumina Refining*

Alumina is the fine white powder refined from Bauxite ore using the 'Bayer Process'. There are 4 stages involved with the Bayer Process:

1. Digestion
2. Clarification
3. Precipitation
4. Calcination

In the **Digestion Stage** the bauxite is crushed and dissolved in a hot mixture of caustic soda.

The **Clarification Stage** involves separating the alumina-bearing solution from the caustic soda and all the Bauxite waste (Bauxite Residue or Red Mud), as well as cooling the mixture dramatically.

In the **Precipitation Stage** crystals of alumina are formed in huge tanks called precipitator vessels.

The **Calcination Stage** involves washing the alumina to remove any excess caustic soda and baking it at around 1000 degrees Celsius to drive off the water. The end result is 100% pure Alumina in the form of a fine white powder.

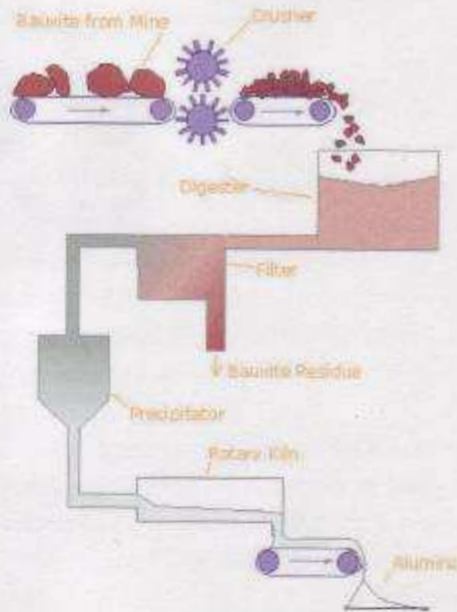


Diagram of the Alumina Refining Process

Australia is the biggest producer of Alumina in the world, and has six Alumina Refineries. The 4 Alumina Refineries in the South West of Western Australia are located near the Bauxite deposits and use natural gas as fuel. The other two Alumina refineries are located at Gove in the Northern Territory and Gladstone in Queensland.

### *Aluminium Smelting*

Aluminium Ingots



At all Aluminium smelting plants, Alumina is dissolved in a solution inside large steel containers known as pots. A very high electric current is passed through the solution converting the Alumina to molten Aluminium. This molten Aluminium is then poured into moulds and left to set solid, and the solid blocks formed by this process are called Aluminium ingots. Pure Aluminium is very soft and not very strong. Therefore, at the molten stage, different amounts of Silicon (for corrosion resistance) and Magnesium (for strength) are generally added to the Aluminium.

Due to the fact that Aluminium smelting needs such large amounts of electrical power, smelters are located in areas which have abundant and cheap power sources such as:-

- hydro electric
- natural gas
- coal
- nuclear

For example (in Australia) the Gladstone Aluminium smelter in Queensland uses electricity from black coal. The Geelong and Portland Aluminium smelters in Victoria both use electricity from Brown Coal.

Recycled Aluminium requires only 5% of the power and electricity to make new Aluminium.

Aluminium is used to make every day items such as

- Soft drink cans
- Window frames
- Screen Doors
- Fly wire
- Foil



### *Environment*

When Bauxite mining is started, the large amounts of top soil are put aside. Once mining has finished, this top soil is then used to cover the ground of the old mine and native vegetation is planted to rehabilitate the area.

The Caustic Red Mud Bauxite waste from the refining process is stored in large mud lakes to prevent contamination of water tables and the surrounding environment.

### *References*

#### Websites

[www.world-aluminium.org](http://www.world-aluminium.org)  
[www.myfuture.edu.au](http://www.myfuture.edu.au)  
[www.liswa.wa.gov.au](http://www.liswa.wa.gov.au)  
[www.energymanagertraining.com](http://www.energymanagertraining.com)

#### Books

World Atlas

#### Other

My Grandpa: Peter Rix - retired Geologist